



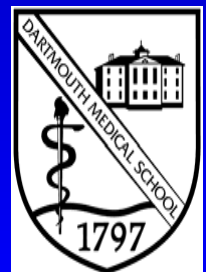
Medical Disaster Conference

Panel Discussion on Threats and Response Plans

Joseph M. Rosen, M.D.

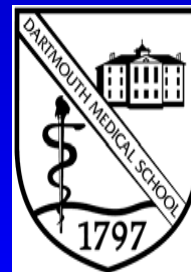
June 13th, 2001

**Natural and Man-made Catastrophes
National Security in the 21st Century**



Catastrophic Medical Disasters CONFERENCE SPONSORS

- ◆ Thayer School of Engineering
- ◆ Dartmouth Medical School
- ◆ US Army Soldier and Biological Chemical Command (SBCCOM)
- ◆ Koop Institute



Purpose of the Panel:

Response Plan Requirements

“A WMD incident on American Soil is likely to overwhelm local fire and rescue squads, medical facilities, and government services.”

US Commission on National Security /21st Century

Purpose of the Panel:

Response Plan Requirements

Attacks may contaminate water, food, and air; large-scale evacuations may be necessary and casualties could be extensive.”

US Commission on National Security /21st Century

Purpose of the Panel:

Response Plan Requirements

“Responsibilities need to be assigned and procedures put in place for these responsibilities to evolve if the situation worsens”

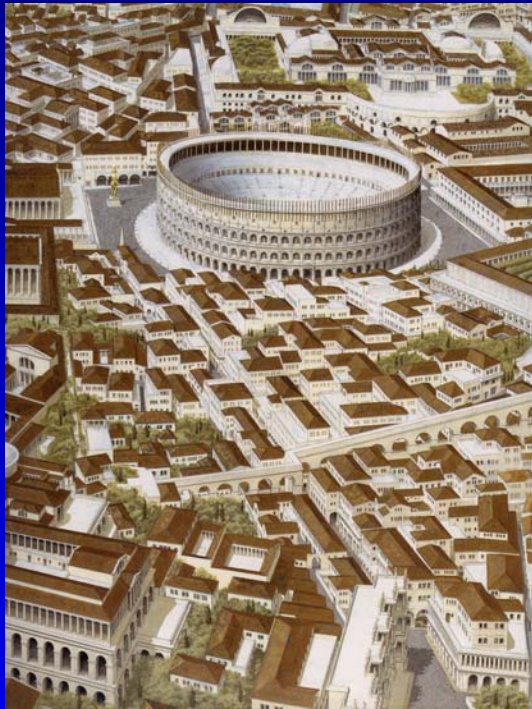
US Commission on National Security /21st Century

Catastrophic Medical Disasters

- ◆ Medical disaster with large number of casualties
- ◆ Ten thousand or more casualties to be cared for
- ◆ Natural or Man-made disaster
- ◆ Public healthcare system not prepared for this event
- ◆ Present healthcare system based on hospital based care

Hospital is central to our modern healthcare system:

Origins of the Modern Hospital Delivery System



- ◆ Major catastrophe near Rome in the year 27 A.D.
- ◆ Collapse of amphitheater at a Gladiatorial contest
- ◆ 20,000 to 50,000 casualties
- ◆ Romans invent Modern Hospital to replace Clinics

Hospital Model is based on Roman system:

Modern Healthcare system is based on Hospital Model

- ◆ **Hospitals today are in a cost crisis**
- ◆ **Hospitals and their emergency departments are severely limited in their reserve capacity to deliver care**
- ◆ **Hospitals today are not designed to respond to catastrophic medical disasters – epidemics and bioweapons**

What Threats will cause a Catastrophic Medical Disaster and change in our care model?

Natural medical catastrophes

- Earthquakes, accidents and epidemics

Terrorist (man-made) attacks

Weapons of Mass Destruction
– Nuclear, Chemical and Biological weapons



Modern Influenza

Natural Epidemic or Man-made Medical Catastrophic Disaster



- ◆ Similar to 1918 Flu Epidemic
- ◆ Direct care causes increased casualties among responders
- ◆ Disease spreads rapidly to other major cities in Northeast region
- ◆ Response overwhelms present modern hospital based healthcare delivery system

Panel of Threats and Response Plans:

Time Critical Operations Response Plan Requirements



- ◆ Early detection of natural epidemic or terrorist attack
- ◆ Quarantine of infected population until agent identified
- ◆ Delivery of rapid assistance to those infected by the agent
- ◆ Timely integration of local, state and federal response plans

Road Map For National Security:

**The United States Commission on
National Security/21st Century**

Imperative for Change March 15,2001

**“The combination of unconventional
weapons proliferation with the
persistence of international
terrorism will end the relative
invulnerability of the U.S. Homeland
to catastrophic attack.”**

Road Map For National Security:

“A direct attack against American Citizens on American soil is likely over the next quarter century”

“In face of this threat, our nation has no coherent or integrated governmental structures.”

Road Map For National Security:

“This commission concludes that significant changes must be made in the structures and processes of the U.S. national security apparatus.”

Stephen Duncan will discuss in his keynote address tomorrow evening

**Catastrophic Terrorism:
are we prepared?**

Response Plans:

Texas state response plan

**Federal response plan and National
Disaster Medical System NDMS**

Improved BW response templates

Extreme Information Infrastructure

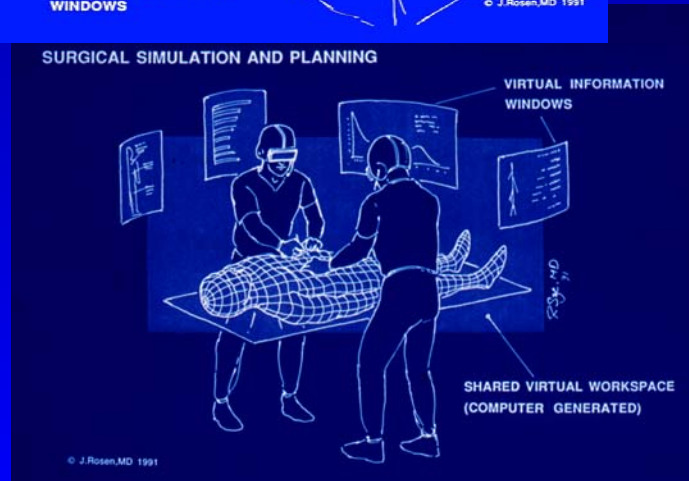
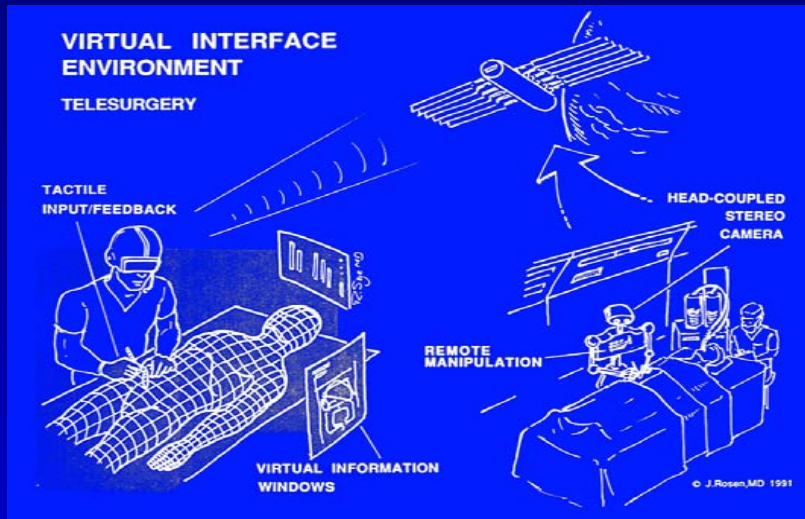
**Cybercare – a new healthcare system
based on a distributed care model
rather than on a centralized
hospital based delivery system**

From Hospital based care to a Cybercare System

Airplane crash in Boston stimulates interest in telecare

Teleoperations from nuclear industry modified for telemedicine uses

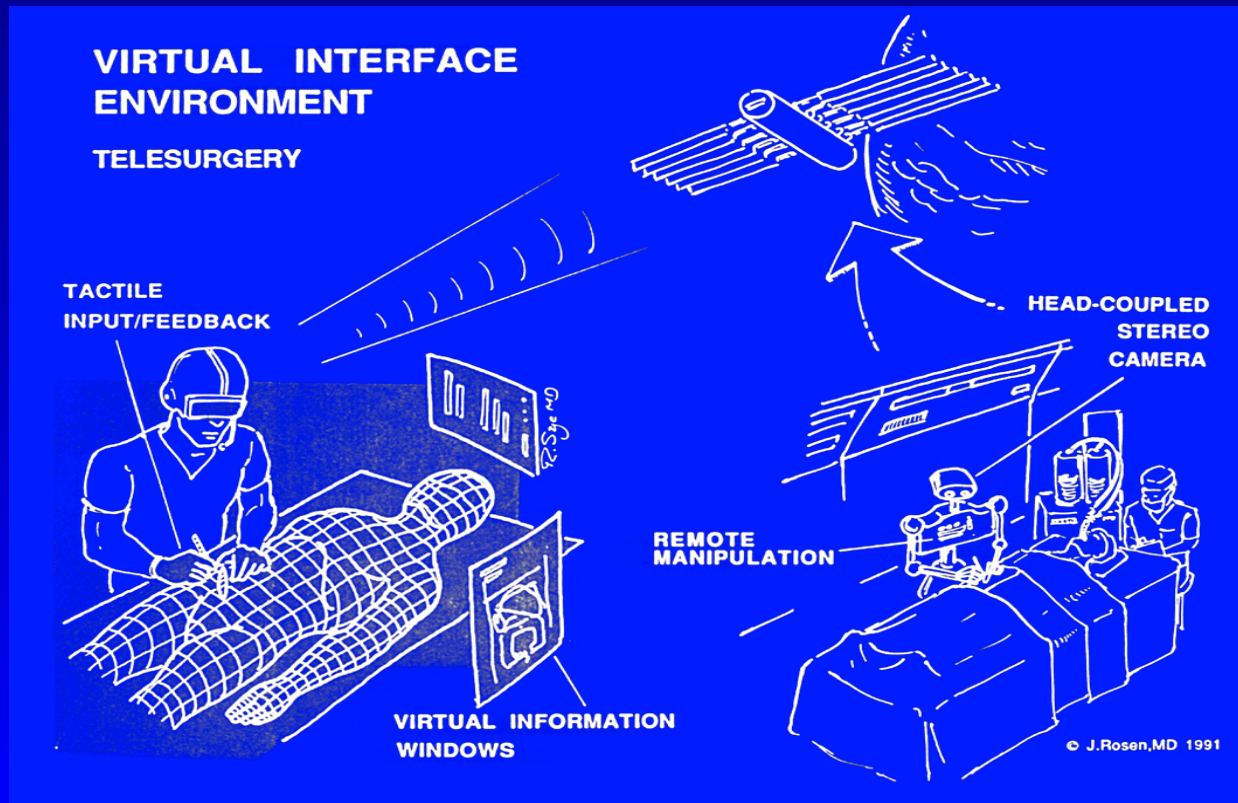
Many pilot projects funded for NASA



Telesurgery vision from NASA 1970's

Telesurgery to provide care to Astronauts in Space

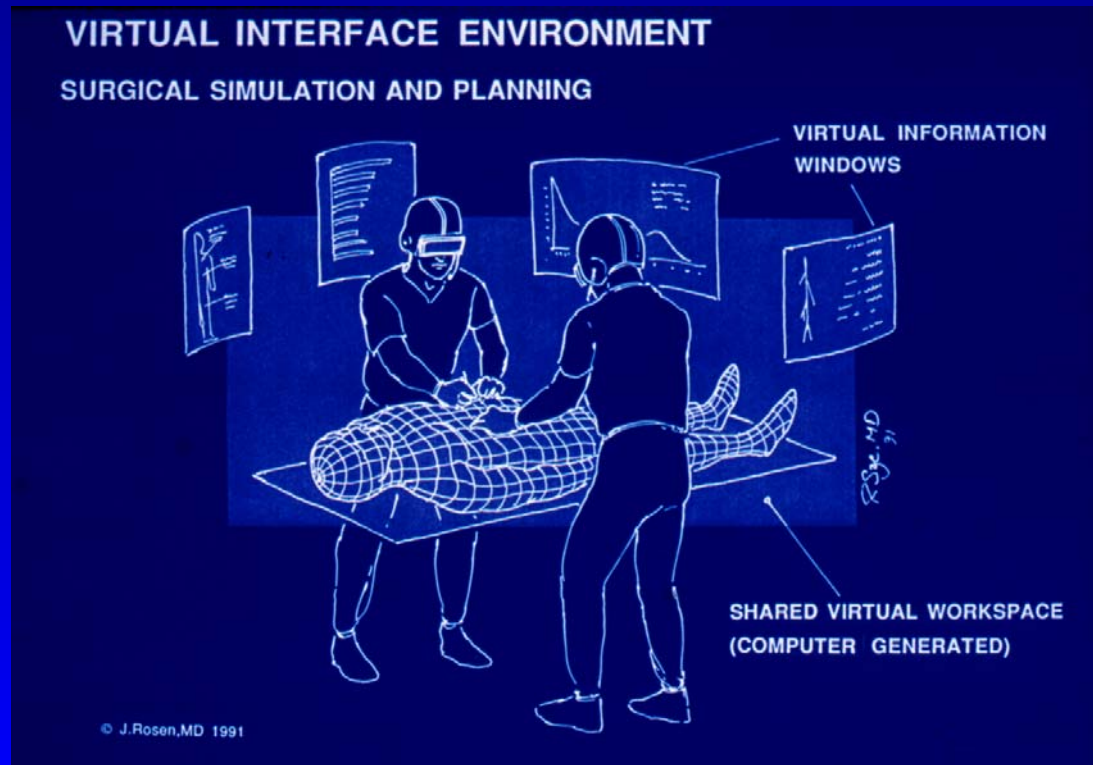
Surgeon in Houston and patient in space



NASA 1980's early virtual reality simulators

Shared virtual environment

Virtual Human with two or more players



Telesurgery in the Battlefield 1990's (DARPA)

Military Medicine will lead a Revolution in Telemedicine

Telesurgery will be provided to the front lines - the surgeon will treat the soldier in the foxhole

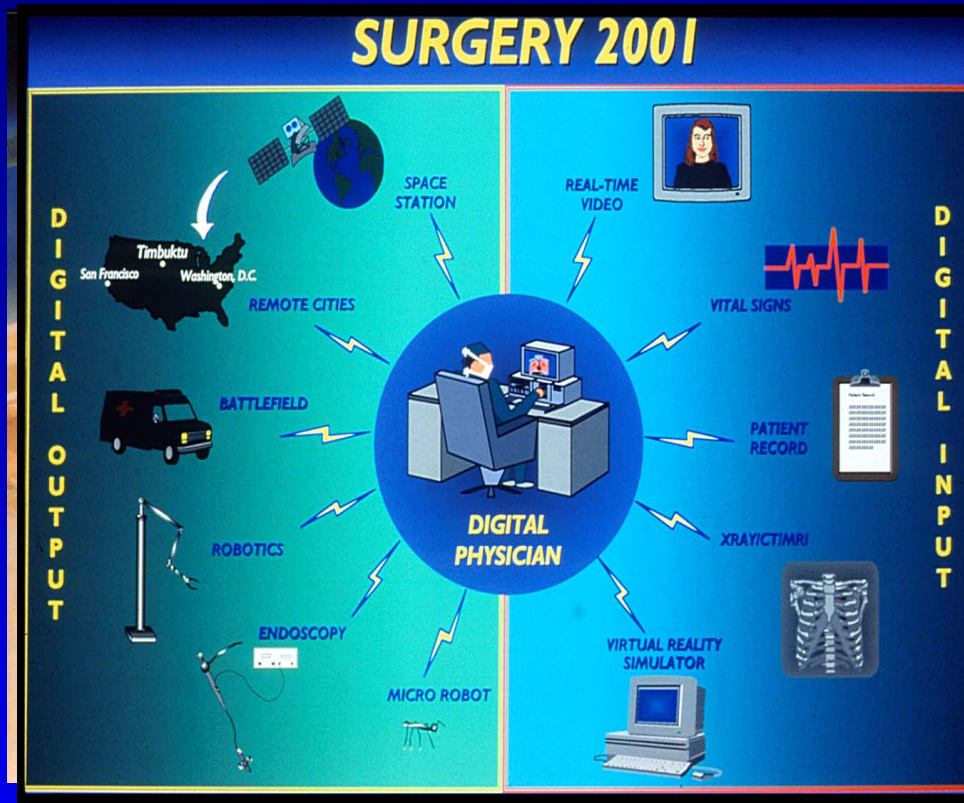


Telesurgery demonstrated at SRI

Telesurgery practical in Civilian applications where bandwidth is readily available



“Digital Physician” Information Revolution



**Satava Concept of
digital physician
in the battlefield**

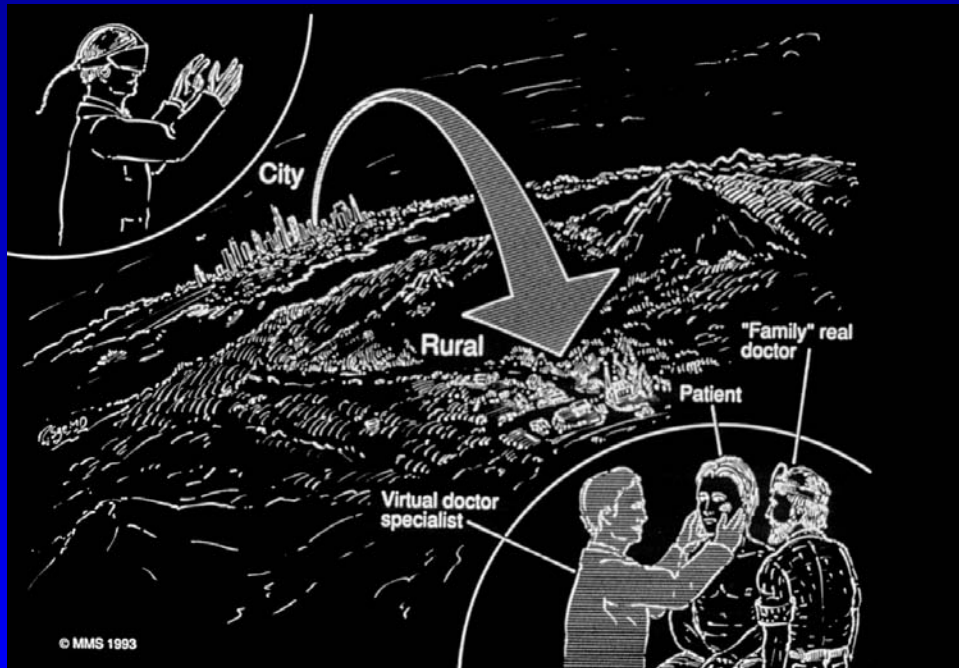
**Revolutionize
practice of civilian
and military
medicine**

**Telesurgery now
becomes
cybersurgery**

Healthcare concept 1993 with Dr Koop

Vision of a New Health Care System

Demonstration of telemedicine, simulation
virtual reality and datacube technologies



Internet based Healthcare System

**Availability of computers and
bandwidth around the world**

Store-forward approach to care

**International medical electronic link
(IMEL)**

**1996 demonstration project
connecting Dartmouth to Nepal**

Definition of Cyber

From the Greek – to steer or govern

Wiener – Cybernetics 1948 – the
science of control systems –
comparing human and computer

Gibson – Neuromancer 1984 –
“Cyberspace” an environment of
interlinked networks providing
access to information and
interactive communication systems

Cybercare = Telemedicine+

Cybersurgery (Satava 1998)

**Tele-medicine, surgery, mentoring,
and distance learning systems**

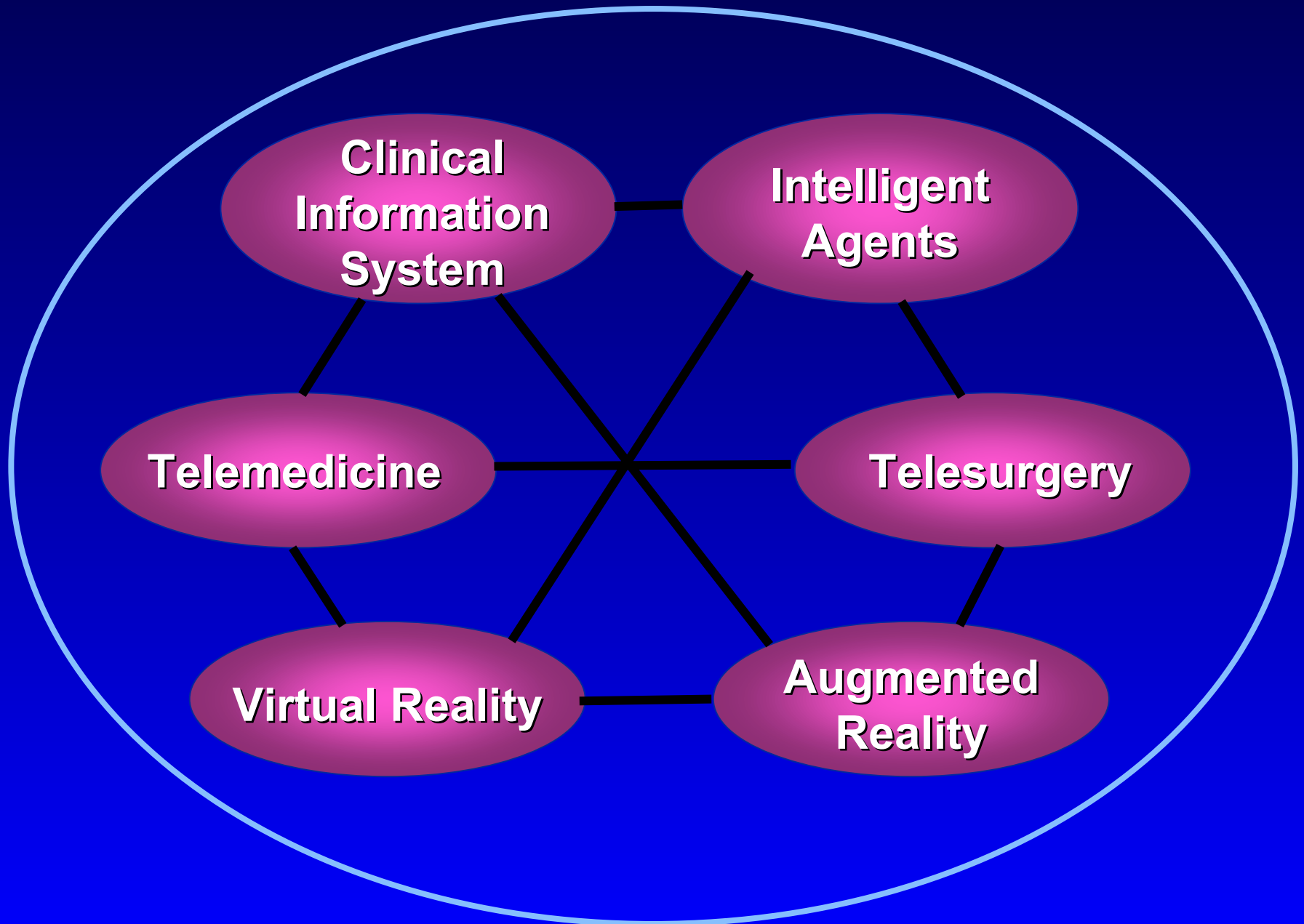
Virtual Reality Simulators

Augmented Reality – datafusion

Clinical information systems

Software Intelligent Agents

Cybercare



Cybercare =

cyberspace + healthcare

- ◆ **Creates a new environment for healthcare at a distance**
- ◆ **Uses present IT with expanded bandwidth and telecommunications**
- ◆ **Combines both physical and virtual worlds within augmented reality system**

Cybercare concept in the Future Response Plan:

What Catastrophe or Disaster will lead to Cybercare?

Natural catastrophes –

Epidemic -

Plague, smallpox or
Influenza

Man-made disaster -

Terrorist Bioweapon
attack or incident



Influenza Epidemic Natural or Man-made Contagious Disaster



- ◆ Similar to 1918 Flu Epidemic
- ◆ Direct care causes increased casualties among responders
- ◆ Disease spreads rapidly to other major cities in Northeast region
- ◆ Response requires national cybercare delivery system

Link major medical centers across country in cyberspace

- ◆ Each affected area is supported by unaffected area in distant region
- ◆ Mobilize most of healthcare system linking through teleoperations
- ◆ Local responders supported through telementoring and telerobotics
- ◆ Complex healthcare network created

Cybercare Response System

Boston first City involved



Boston

New York

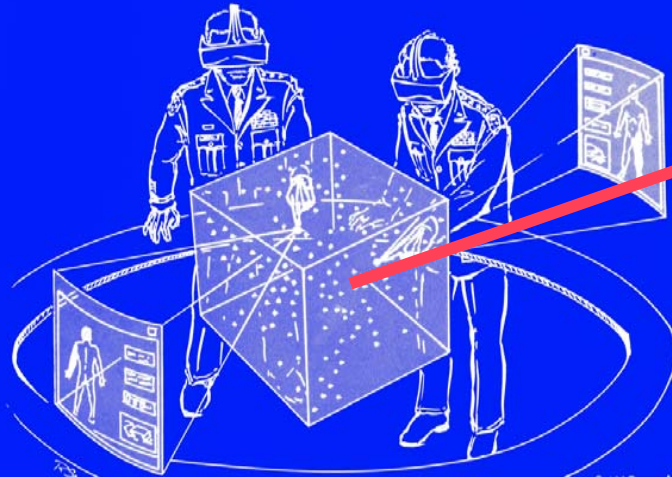
Washington D.C.

Telepresence and Telesurgery/robotic System assisting Local surgeons in Case of an Earthquake

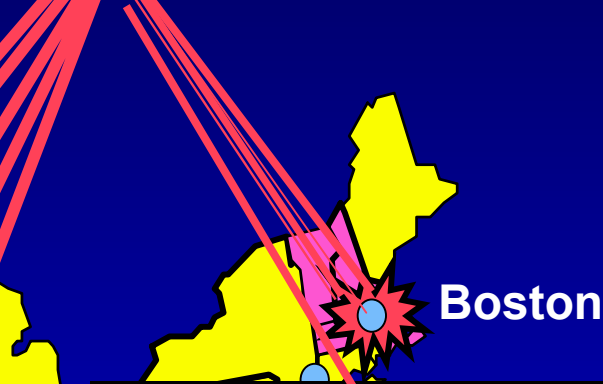
Future Scenario

Cybercare Response System

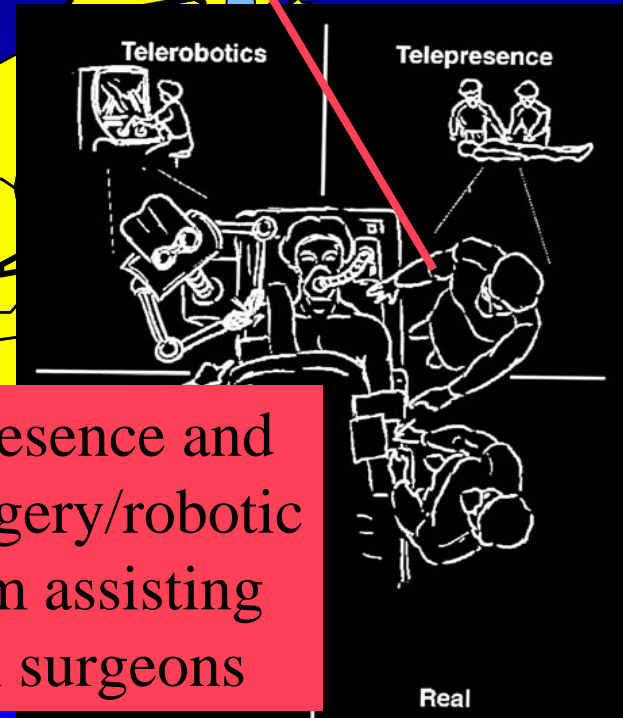
Boston first City attacked



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Boston



Telepresence and
Telesurgery/robotic
System assisting
Local surgeons

Future
Scenario

Cybercare Response System

Spreads to New York City



Boston

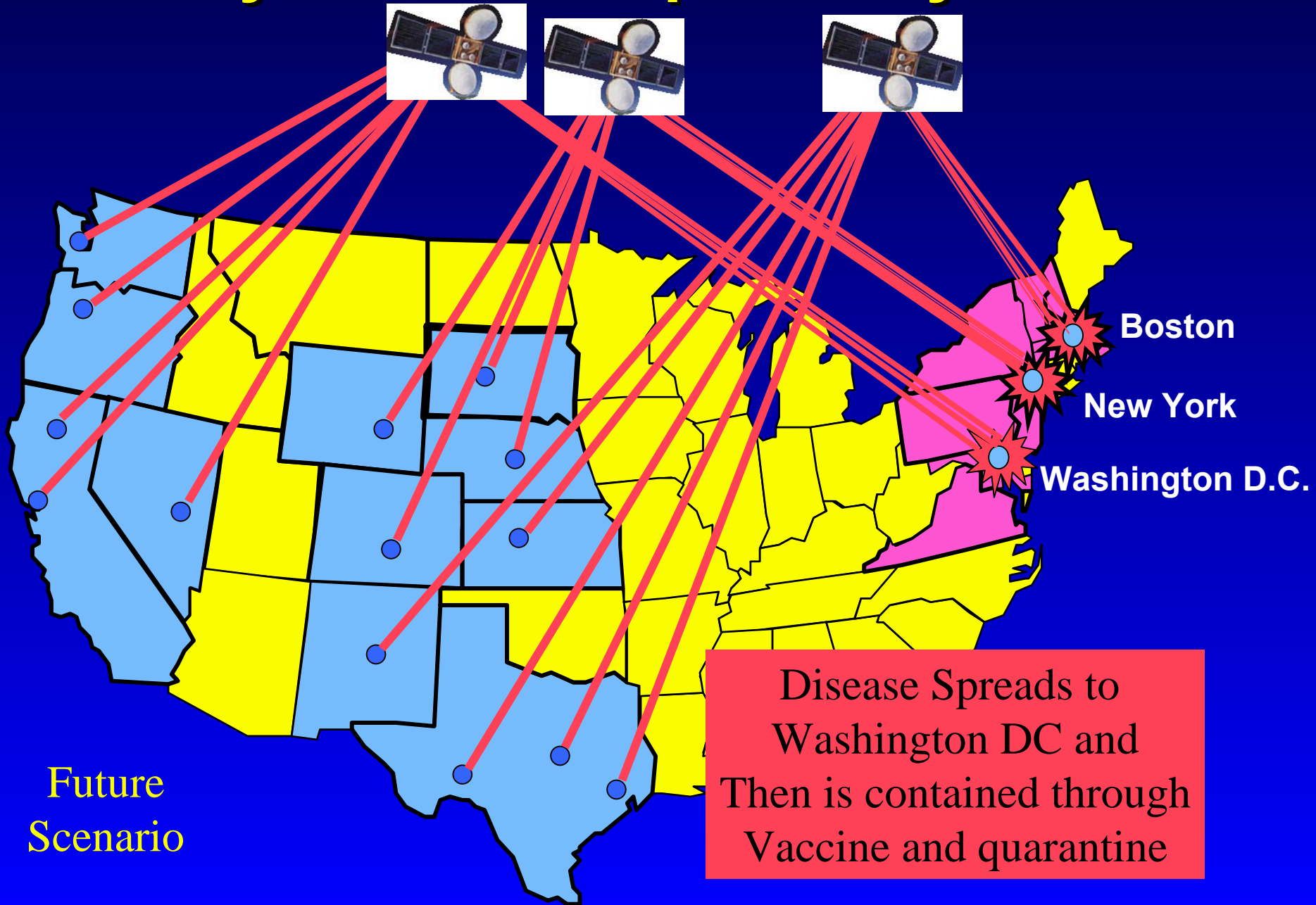
New York

Washington D.C.

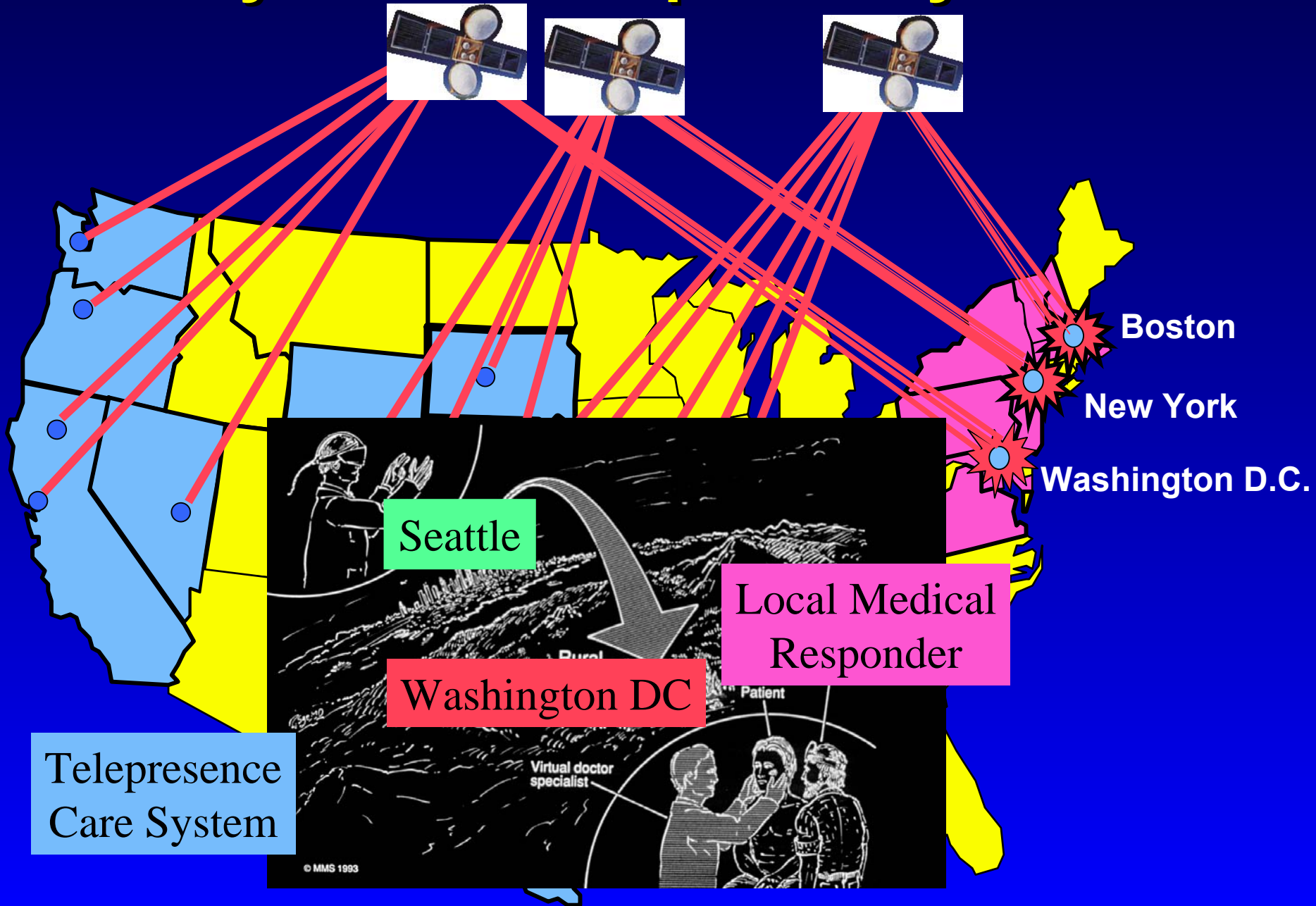
Cybercare system brings on Multiple additional remote Sites to provide assistance

Future Scenario

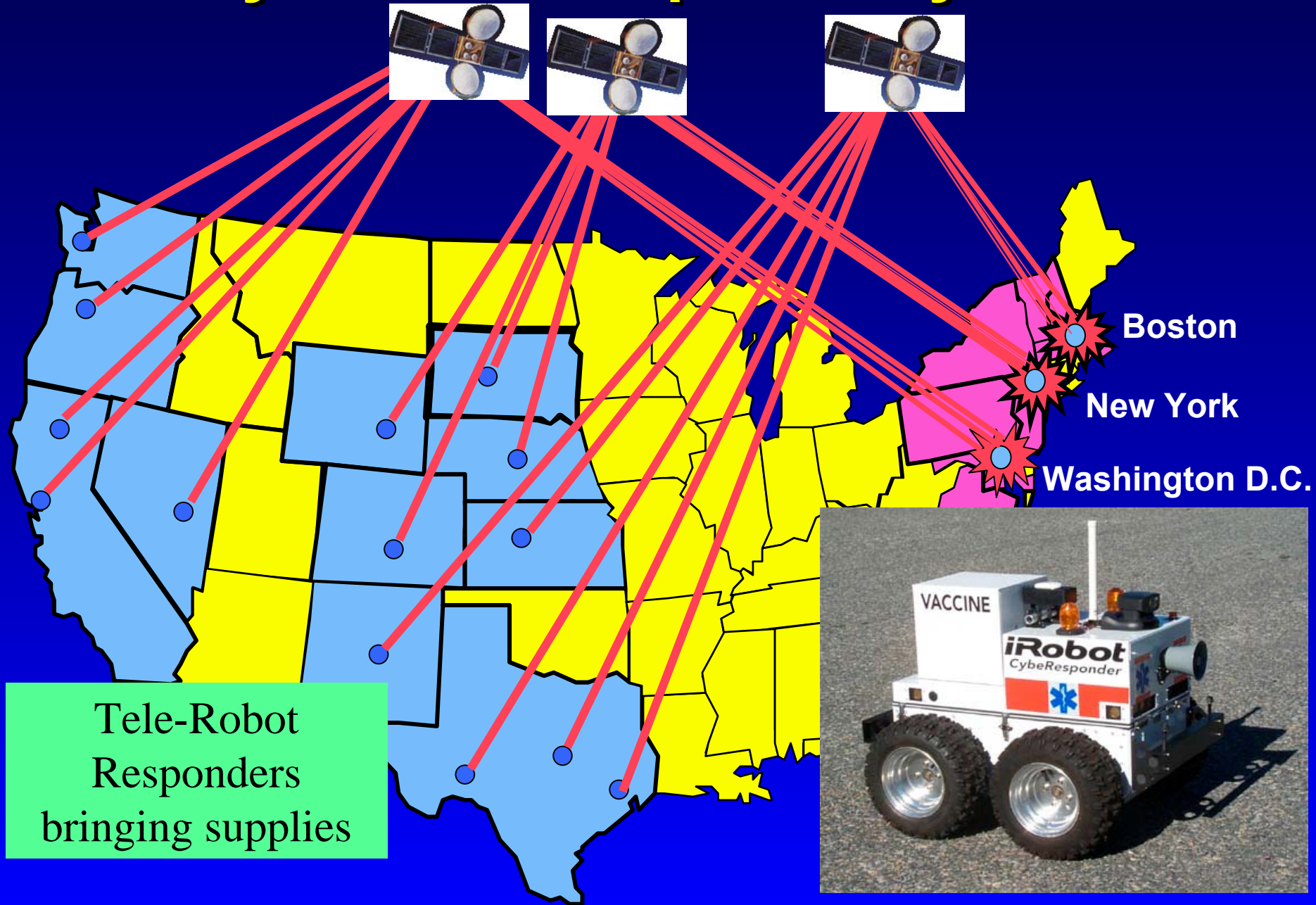
Cybercare Response System



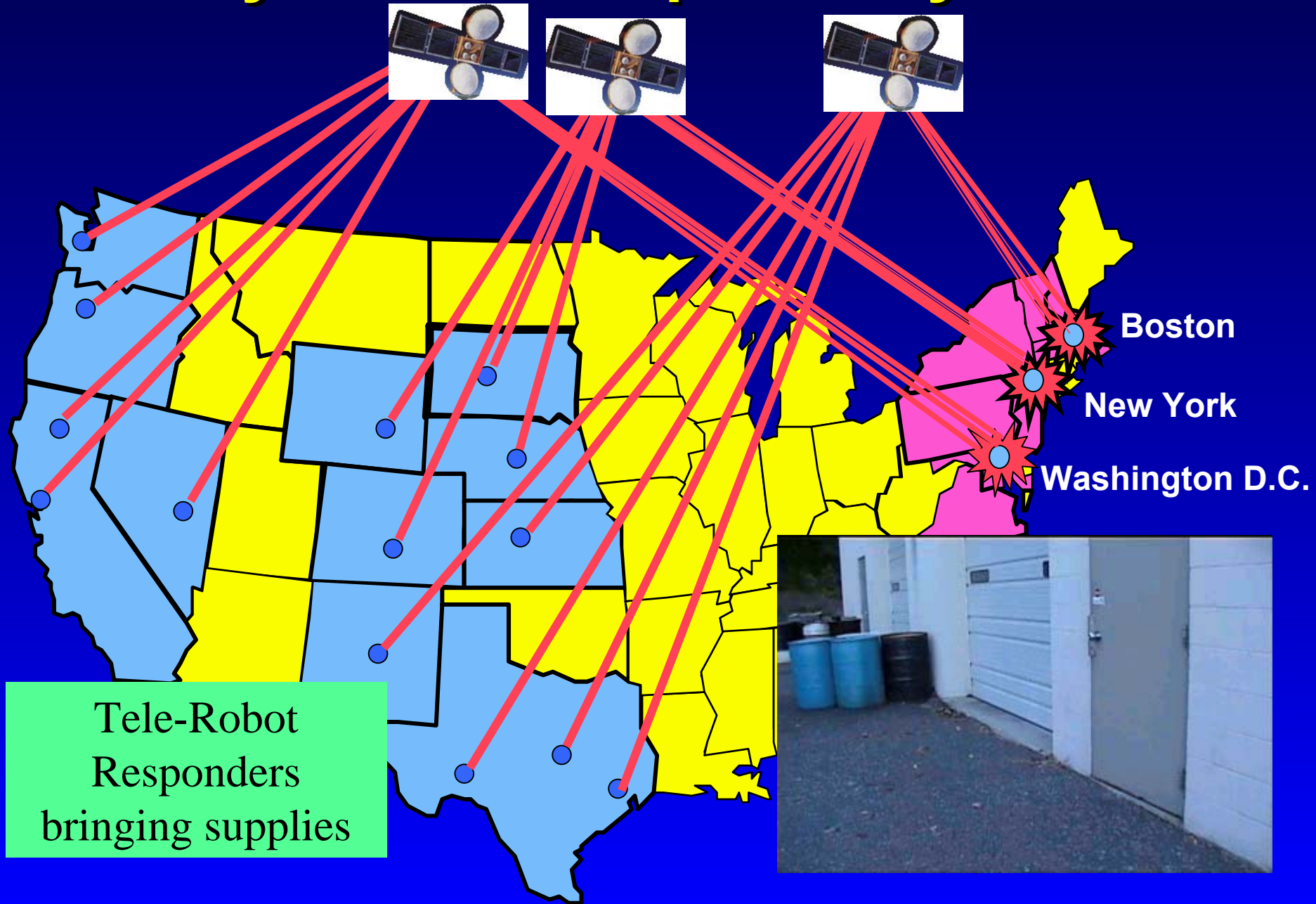
Cybercare Response System



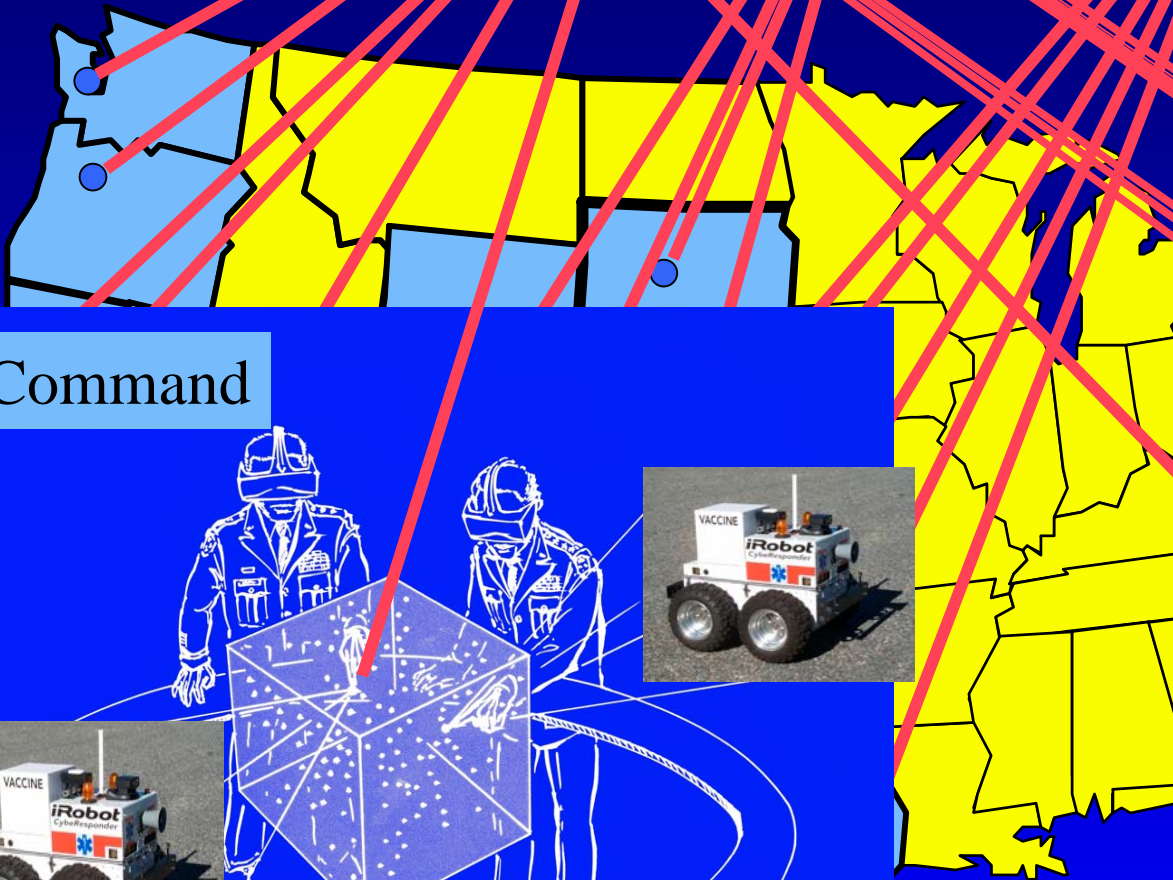
Cybercare Response System



Cybercare Response System



Cybercare Response System



Command



Cybercare Conclusion:

- ◆ Multiple tele-care systems with emphasis on robotics over humans
- ◆ Simulation environment (SIMNET) for healthcare (MEDNET) – virtual reality
- ◆ Cyberspace – integrates all of the IT systems within augmented reality

Thank You

Panel discussion

On threats and response plans

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